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TRANSMITTAL OF APPEAL BRIEF (Large Entity)	Docket No. YOR920000019US1

In Re Application Of: **Dimitri Kanevsky, et al.**

Application No.	Filing Date	Examiner	Customer No.	Group Art Unit	Confirmation No.
09/603,980	June 27, 2000	Jean E. Lesperance	23389	2674	4672

Invention: **A VIRTUAL INVISIBLE KEYBOARD**

COMMISSIONER FOR PATENTS:

Transmitted herewith in triplicate is the Appeal Brief in this application, with respect to the Notice of Appeal filed on **March 1, 2005.**

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Dated: **May 2, 2005**

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IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Applicant(s):	Dimitri Kanevsky, et al.	**Examiner:**	Jean E. Lesperance
Serial No.:	09/603,980	**Art Unit:**	2674
Filed:	June 27, 2000	**Docket:**	YOR920000019US1 (13317)
For:	A VIRTUAL INVISIBLE KEYBOARD	**Dated:**	May 2, 2005

Confirmation No. 4672

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Alexandria, VA 22313-1450

APPEAL BRIEF

Sir:

Pursuant to 35 U.S.C. 134 and 37 C.F.R. 41.37, entry of this Appeal Brief in support of the Notice of Appeal filed March 1, 2005 in the above-identified matter is respectfully requested.

CERTIFICATE OF MAILING UNDER 37 C.F.R. §1.8(a)

I hereby certify that this correspondence is being deposited with the United States Postal Service as first class mail in an envelope addressed to: Commissioner for Patents, United States Patent and Trademark Office, Mail Stop Appeal Brief – Patents, P.O. Box 1450, Alexandria, VA 22313-1450, on May 2, 2005.

Date: May 2, 2005

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I. Statement of Real Party in Interest

The real party in interest in the above-identified patent application is the International Business Machines Corporation.

II. Statement of Related Proceedings

There are no prior or pending appeals or interferences related to this application to Appellant's knowledge.

III. Statement of Supporting Evidence

Applicants are not relying on any affidavits, extrinsic documents or extrinsic evidence.

IV. Statement of Claim Status and Appealed Claims

A. Claim Status

Claim 1 stands rejected under 35 U.S.C. §103 as being unpatentable over U.S. Patent No. 5,767,842 (Korth) in view of U.S. Patent 6,407,679 (Evans, et al.), and under 35 U.S.C. §112, first paragraph, as failing to comply with the written description requirement.

Claim 2 stands rejected under 35 U.S.C. §103 as being unpatentable over U.S. Patent No. 5,767,842 (Korth) in view of U.S. Patent 6,407,679 (Evans, et al.), and under 35 U.S.C. §112, first paragraph, as failing to comply with the written description requirement.

Claim 3 stands rejected under 35 U.S.C. §103 as being unpatentable over U.S. Patent No. 5,767,842 (Korth) in view of U.S. Patent 6,407,679 (Evans, et al.), and under 35 U.S.C. §112, first paragraph, as failing to comply with the written description requirement.

Claim 4 stands rejected under 35 U.S.C. §103 as being unpatentable over U.S. Patent No. 5,767,842 (Korth) in view of U.S. Patent 6,407,679 (Evans, et al.), and under 35 U.S.C. §112, first paragraph, as failing to comply with the written description requirement.

Claim 5 stands rejected under 35 U.S.C. §103 as being unpatentable over U.S. Patent No. 5,767,842 (Korth) in view of U.S. Patent 6,407,679 (Evans, et al.), and under 35 U.S.C. §112, first paragraph, as failing to comply with the written description requirement.

Claim 6 stands rejected under 35 U.S.C. §103 as being unpatentable over U.S. Patent No. 5,767,842 (Korth) in view of U.S. Patent 6,407,679 (Evans, et al.), and under 35

U.S.C. §112, first paragraph, as failing to comply with the written description requirement.

Claim 7 stands rejected under 35 U.S.C. §103 as being unpatentable over U.S. Patent No. 5,767,842 (Korth) in view of U.S. Patent 6,407,679 (Evans, et al.), and under 35 U.S.C. §112, first paragraph, as failing to comply with the written description requirement.

Claim 8 stands rejected under 35 U.S.C. §103 as being unpatentable over U.S. Patent No. 5,767,842 (Korth) in view of U.S. Patent 6,407,679 (Evans, et al.), and under 35 U.S.C. §112, first paragraph, as failing to comply with the written requirement.

Claim 9 stands rejected under 35 U.S.C. §103 as being unpatentable over U.S. Patent No. 5,767,842 (Korth) in view of U.S. Patent 6,407,679 (Evans, et al.), and under 35 U.S.C. §112, first paragraph, as failing to comply with the written description requirement.

Claim 10 stands rejected under 35 U.S.C. §103 as being unpatentable over U.S. Patent No. 5,767,842 (Korth) in view of U.S. Patent 6,407,679 (Evans, et al.), and under 35 U.S.C. §112, first paragraph, as failing to comply with the written description requirement.

Claim 11 stands rejected under 35 U.S.C. §103 as being unpatentable over U.S. Patent No. 5,767,842 (Korth) in view of U.S. Patent 6,407,679 (Evans, et al.), and under 35 U.S.C. §112, first paragraph, as failing to comply with the written description requirement.

Claim 12 stands rejected under 35 U.S.C. §103 as being unpatentable over U.S. Patent No. 5,767,842 (Korth) in view of U.S. Patent 6,407,679 (Evans, et al.), and under 35 U.S.C. §112, first paragraph, as failing to comply with the written description requirement.

Claim 14 stands rejected under 35 U.S.C. §103 as being unpatentable over U.S. Patent No. 5,767,842 (Korth) in view of U.S. Patent 6,407,679 (Evans, et al.), and under 35 U.S.C. §112, first paragraph, as failing to comply with the written description requirement.

Claim 15 stands rejected under 35 U.S.C. §103 as being unpatentable over U.S. Patent No. 5,767,842 (Korth) in view of U.S. Patent 6,407,679 (Evans, et al.), and under 35 U.S.C. §112, first paragraph, as failing to comply with the written description requirement.

Claim 16 stands rejected under 35 U.S.C. §103 as being unpatentable over U.S. Patent No. 5,767,842 (Korth) in view of U.S. Patent 6,407,679 (Evans, et al.), and under 35 U.S.C. §112, first paragraph, as failing to comply with the written description requirement.

Claim 17 stands rejected under 35 U.S.C. §103 as being unpatentable over U.S. Patent No. 5,767,842 (Korth) in view of U.S. Patent 6,407,679 (Evans, et al.), and under 35 U.S.C. §112, first paragraph, as failing to comply with the written description requirement.

Claim 18 stands rejected under 35 U.S.C. §103 as being unpatentable over U.S. Patent No. 5,767,842 (Korth) in view of U.S. Patent 6,407,679 (Evans, et al.), and under 35 U.S.C. §112, first paragraph, as failing to comply with the written description requirement.

Claim 19 stands rejected under 35 U.S.C. §103 as being unpatentable over U.S. Patent No. 5,767,842 (Korth) in view of U.S. Patent 6,407,679 (Evans, et al.), and under 35 U.S.C. §112, first paragraph, as failing to comply with the written description requirement.

Claim 21 stands rejected under 35 U.S.C. §103 as being unpatentable over U.S. Patent No. 5,767,842 (Korth) in view of U.S. Patent 6,407,679 (Evans, et al.), and under 35 U.S.C. §112, first paragraph, as failing to comply with the written description requirement.

Claim 22 stands rejected under 35 U.S.C. §103 as being unpatentable over U.S. Patent No. 5,767,842 (Korth) in view of U.S. Patent 6,407,679 (Evans, et al.), and under 35 U.S.C. §112, first paragraph, as failing to comply with the written description requirement.

Claim 23 stands rejected under 35 U.S.C. §103 as being unpatentable over U.S. Patent No. 5,767,842 (Korth) in view of U.S. Patent 6,407,679 (Evans, et al.), and under 35 U.S.C. §112, first paragraph, as failing to comply with the written description requirement.

Claim 24 stands rejected under 35 U.S.C. §103 as being unpatentable over U.S. Patent No. 5,767,842 (Korth) in view of U.S. Patent 6,407,679 (Evans, et al.), and under 35 U.S.C. §112, first paragraph, as failing to comply with the written description requirement.

B. Appealed Claims

Claims 1-12, 14-19 and 21-24 are appealed. A clean copy of these claims is contained in Appendix A to this Appeal Brief.

V. Statement of Amendment Status

No amendments are pending in this application. The last Amendment filed in this case was dated January 3, 2005. That Amendment has been entered.

VI. Statement/Explanation of Invention

The present invention, generally, relates to methods and systems for generating text or data from typing gestures made without any real physical keyboard. In the practice of this invention, a person (103) moves his or her hands as if that person was typing, and using various computer processes (200, 201, 202, 203), those finger movements are transformed into text (204). In particular, these computer processes (200, 201, 202, 203) classify the finger gestures into classes, and then associated each of those classes with one of the keys of a keyboard.

With preferred embodiment of the invention, images of the finger gestures (500) are taken. The computer processes are then used to classify these gesture images into classes (503) to associate each of those classes with one or more possible keys (504) and to assign a probability to each of those possible keys. After a sequence of classes, the probabilities assigned to the possible keys are integrated to identify a word for that sequence of classes. Each word is identified on the basis of the probabilities assigned to the possible keys assigned to the gesture classes that make up that word.

VII. Statement/List of Each Ground for Review

1. Rejection under 35 U.S.C. 112, first paragraph.

    a. The rejection

Claims 1-12, 14-19 and 21-24 are rejected under 35 U.S.C. 112, first paragraph, as failing to comply with the written description requirement.

    b. Argument

With respect to the rejection of the claims under 35 U.S.C. §112, the Examiner argued in the Office Action dated November 1, 2004, that the specification does not provide the appropriate written support for the description in the claims of the features that the typing gestures are "made in a touch-sensor free environment." Applicants, in the Amendment dated January 3, 2005 and which was entered, slightly rephrased this language in the claims to indicate, more specifically, that the typing gestures are made "without touching any touch sensors." In order to provide an express support for this language in the claims, the specification on page 5 was also amended in that amendment to indicate that the typing gestures shown in Figure 1 are made without touching any touch sensors.

This feature is clearly shown in Figure 1 of the application, and is readily understood by those of ordinary skill in the art from a review of that Figure and the discussion thereof on pages 4 and 5 of the application. Moreover, with these changes, the application now provides the appropriate written description of the claimed subject matter.

In view of the foregoing, the Examiner's rejection of the claims under 35 U.S.C. §112 has been overcome, and the Board is asked to reverse the rejection of claims 1-12, 14-19 and 21-24 under 35 U.S.C. §112.

2. Rejection under 35 U.S.C. 103 based on U.S. Patents 5,767,842 (Korth) and 6,407,679 (Evans, et al.).

a. The rejection

Claims 1-12, 14-19 and 21-24 are rejected under 35 U.S.C. 103 as being unpatentable over U.S. Patent 5,767,842 (Korth) in view of U.S. Patent No. 6,407,679 (Evans, et al.).

b. U.S. Patent 5,767,842

Korth describes a virtual typing procedure in which hand and finger movements are interpreted as operations on a physically non-existent computer keyboard or similar input device. In this procedure, an image acquisition system is provided to monitor the hand and finger motions and gestures of a human use, and these activities are interpreted as operations on a keyboard or other input device. This image acquisition system comprises a video sensor, and means for digitizing the processing signals from that sensor.

The Examiner has noted that several important aspects of the invention are not disclosed in Korth, and thus, the Examiner relies on Evans, et al. to support the rejection of the claims.

c. U.S. Patent No. 6,407, 679

Evans, et al discloses a procedure for converting finger movement into text. With the procedure disclosed in Evans, et al, each finger gesture is assigned a number, a series of numbers is formed, and that series is matched to one or more possible words. After a sentence is completed, all possible sentences are formed, a probability is assigned to each sentence possibility, and the most probable sentence is selected.

d. Features of the claims that are not disclosed or suggested by the prior art.

The following features of the present inventions are not disclosed in or suggested by the prior art.

(i) A virtual typing procedure, as described in independent claims 1, 4, 8, 9, 10, 14, 17 and 21, that uses a virtual and invisible keyboard, as described in these claims.

(ii) A virtual typing procedure, as described in independent claims 1, 4, 8, 9, 10, 14, 17 and 21, in which each word is identified on the basis of the probabilities assigned to the gesture classes that make up that word.

e. Argument

As indicated above, neither Korth nor Evans, et al. discloses or suggests a virtual typing procedure that uses a virtual and invisible keyboard. More specifically, Korth assumes that the user sees a virtual keyboard, either printed on a table or seen on a monitor. With the present invention, in contrast, the user does not see a virtual keyboard at all. The user may not even have a table in front of him. Because of this, in this invention, the typing processes are a set of gestures that imitate some typical typing movements but they are so vague that they require a statistical recognition process that interprets gestures, similar to the way a speech recognition machine interprets speech.

It is noted that, in the Office Action of November 1, 2004 the Examiner argued that Korth discloses a physically non-existent input device and that this corresponds to an invisible virtual keyboard. Applicants respectfully submit that a virtual keyboard is not the same as a virtual invisible keyboard. The virtual keyboard of Korth is clearly visible; this is plainly shown in Figure 1 of Korth. In the present invention, in contrast, the keyboard is not only virtual (there is no real keyboard), but it also is not visible (there is no image of any keyboard, and it cannot be seen). The keyboard exists only in the mind of the user. Further, it is the use of this invisible keyboard that necessitates the above-discussed gesture analysis procedure that is needed in the operation of the present invention.

Each of independent claims 1, 4, 8, 9, 10, 14, 17 and 21 describes a virtual invisible keyboard. More specifically, Claim 1 describes an information input processing computer system for mapping gestures to keys of an invisible keyboard, and claim 4 describes an information processing, gesture-key mapping computer system for generating text from hand gestures of a user relative to an invisible keyboard. Claims 8 and 9 both describe a method for producing a textual output in which a user makes typing like gestures relative to a virtual, invisible keyboard. Claims 10 and 14 are directed to a method of typing, and both of these claims positively set forth the step of making typing gestures relative to a virtual, invisible keyboard. Analogously, Claims 17 and 21 are directed to a typing system using a virtual invisible keyboard, and these claims set forth means for sensing typing gestures made relative to a virtual, invisible keyboard.

In addition to the foregoing, another important feature of this invention that is not shown in or suggested by the prior art, is the specific way in which the present invention translates gestures into text.

As mentioned above, with the present invention, images of the gestures are taken or captured, and the computer processes are used to classify gesture images into classes, to associate each of those classes with one or more possible keys, and to assign a probability

to each of those possible keys. Then, for a sequence of classes, the probabilities assigned to the possible keys associated with the sequence are integrated to identify a word for that sequence of classes.

Korth discloses a virtual typing system in which hand and finger movements are interpreted as operations on a physically non-existent computer keyboard or other input device. The Examiner has noted in previous Office Actions (see Office Action of July 16, 2003, page 3, lines 5-7) that Korth does not disclose classifying gestures into classes and associating each of those classes with one of the keys of the keyboard. The Examiner argued, though, that Evans, et al teaches these or similar functions.

Evans, et al discloses a procedure for converting finger movement into text. However, the specific procedure used in Evans, et al to perform that conversion is quite different than the specific procedure used in the practice of the present invention.

To elaborate, with the procedure disclosed in Evans, et al, each finger gesture is assigned a number, a series of numbers is formed, and that series is matched to one or more possible words. After a sentence is completed, all possible sentences are formed, a probability is assigned to each sentence possibility, and the most probable sentence is selected.

In contrast, with this invention, text is determined on a word by word basis rather than on a sentence by sentence basis. With the present invention, each word is identified on the basis of the probabilities assigned to the possible keys assigned to the gesture classes that make up that word.

This feature is of utility because it provides a quicker feedback to the user. With the procedure used in Evans, et al, a complete sentence must be finished before a final text is determined. The present invention, in comparison, is able to determine each word immediately after the word is input.

Independent Claims 1, 4, 8, 9, 10, 14, 17 and 21 clearly describe this feature of the invention. More specifically, each of Claims 1, 8, 9, 10 and 17 indicates that the computer processes described in the claims, among other functions, associate each of the classes with one or more possible keys, assign a probability to each of those possible keys, and integrate the probabilities assigned to the possible keys to identify a word for a sequence of gestures.

Claim 4 indicates that the associator module associates gesture classes with one or more possible keys, and that the integrator module integrates the probabilities assigned to the possible keys to identify a word for a sequence of gestures. In addition, Claims 14 describes the producing step as including the step of associating each of the classes with one or more possible keys, assigning a probability to each of said possible keys, and integrating the probabilities assigned to the possible keys to identify a word for a sequence of gestures. Claim 21, which is directed to a typing system, includes analogous apparatus limitations.

Appellants respectfully submit that the important consideration is not whether the reference could be modified to produce the present invention, but whether it would have been obvious to do so.

As the Court of Appeals for the Federal Circuit has taught:

"an 'obvious to try' standard is not a legitimate test of patentability...The statutory standard of 103 is whether the invention, considered as a whole, would have been obvious to one skilled in the art, not whether it would have been obvious to one skilled in the art to try various combinations." N.V. Akzo v. E.I. duPont deNemours & Co., 1 USPQ2d 1704, 1707 (Fed Cir. 1987).

Appellants submit that, because of the above-discussed differences between the prior art and Claims 1, 4, 8, 9, 10, 14, 17 and 21, these claims, when judged according to the proper standard, patentably distinguish over the prior art. Claims 2 and 3 are dependent from Claim 1 and are allowable therewith; Claims 5, 6 and 7 are dependent from, and are allowable with, Claim 4; and Claims 11, 12, 22 and 23 are dependent from Claim 10 and are allowable therewith. Similarly, Claims 15 and 16 are dependent from, and are allowable with, Claim 14; Claims 18 and 19 are dependent from Claim 17 and are allowable therewith; and Claim 22 is dependent from, and is allowable with, Claim 21.

VIII. Conclusion

The specification provides the appropriate written support, within the meaning of 35 U.S.C. §112, first paragraph, for claims 1-12, 14-19 and 21-24. In particular, the specification includes a written description of the feature that the typing gestures are made "without touching any touch sensor." Accordingly, the Board of Appeals is requested to reverse the rejection of claims 1-12, 14-19, and 21-24 under 35 U.S.C. §112.

The prior art, and specifically, Korth and Evans, et al. does not disclose or suggest a number of important features of the present invention that are described in independent Claims 1, 4, 8, 9, 10, 14, 17 and 21. Specifically, the prior art does not teach a virtual typing procedure, as described in these independent claims, that uses a virtual and invisible keyboard. Also, the prior art does not disclose or suggest a virtual typing procedure, as described in independent claims 1, 4, 8, 9, 10, 14, 17 and 21, in which each word is identified on the basis of the probabilities assigned to the gesture classes that make up that word. Accordingly, the rejection of these claims under 35 U.S.C. §103 is not proper. As indicated immediately above, the remaining pending claims as dependent from one of claims 1, 4, 8, 9, 10, 14, 17 or 21, and are thus also allowable.

The Board of Appeals is thus also respectfully asked to reverse the rejection of claims 1-12, 14-19 and 21-24 under 35 U.S.C. §103.

Respectfully submitted,

Dated: May 2, 2005

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Enclosure: Appendix A

APPENDIX "A"

Claim 1: An information input processing computer system for mapping gestures to keys of a virtual invisible keyboard, the system comprising one or several cameras, one or more memories with CPU connected to the cameras, and processes running in the CPU that associate gesture movements made without touching any touch sensors with typing and produce gesture associated textual output, wherein said processes capture gesture images, classify each type of gesture image into a respective one of a plurality of classes depending on the type of gesture, and associate each of the classes with one or more possible keys of the invisible keyboard, assign a probability to each of said possible keys, and integrate the probabilities assigned to the possible keys to identify a word for a sequence of gestures.

Claim 2: The gesture-key mapping system as in claim 1, where a feedback is provided to the user on what kind of keys are associated with the user's gestures.

Claim 3: The gesture-key mapping system as in claim 2, where the feedback is provided using one or more of the following: displaying keys on a display, playing sounds labels for keys, displaying image indicators on a display, playing special sound indicators, projecting the keyboard to any surface, and displaying picture of the keyboard with user's hands.

Claim 4: An information input processing, gesture-key mapping computer system for generating text from hand gestures of a user relative to an invisible keyboard, the system comprising one or several cameras, one or more memories with CPU connected to the cameras, and processes running in the CPU that associate gesture movements with typing and produce gesture associated textual output, where the gesture-key processing is provided using the following modules:

a) a gesture capturing module that captures gestures, relative to an invisible keyboard and made without touching any touch sensors, through camera sensors;

b) a gesture classificator module that classifies each type of gesture into a respective one of a plurality of classes depending on the type of gesture movements;

c) an associator module for associating gesture classes or sequence of gesture classes with one or more possible keys of the invisible keyboard and assigns a probability to each of said possible keys; and

d) an integrator module that integrates the probabilities assigned to the possible keys to identify a word for a sequence of gestures.

Claim 5: The system as in claim 4, where the integrator module includes one or more of the following:

a) language module component that estimate probabilities of word strings corresponding to key candidate sequences;

b) character frequency module that estimate probabilities of character strings corresponding key candidate sequences;

c) confusable matrix that estimate how often correct gesture classes are confusable with another gesture classes;

d) gesture classes probability model that estimate probability of observing a string of gesture classes given a sequence of gesture frames;

e) computation of a probability of production a sequence of keys given a string of gesture frames;

f) generation of a lattice of sequences of keys given sequence of gesture frames;

g) finding the most probable sequence of keys from the lattice of key candidate strings.

Claim 6: A system according to Claim 5, wherein each sequence of keys receives a probability score, and the sequences of keys that receive low scores are removed and are not continuing when new candidates for keys arrive.

Claim 7: A system according to Claim 4, further comprising a gesture correlator module to allow to adjust automatically the invisible keyboard to changes in the hand positions of the user, and wherein the gesture correlator module acts between the gesture classificator module and the associator module to maintain a consistent mapping of gesture classes to keys of the invisible keyboard despite said changes in the hand positions of the user.

Claim 8: The method for producing a textual output in which a user makes typing like gesture relative to a virtual, invisible keyboard made without touching any touch sensors and without the presence of a real keyboard and the gestures are associated with the most probable keys that would be typed if a keyboard were presented, said method including the steps of using a computer system to map gestures made, without touching any touch sensors, to keys of the virtual keyboard, including the steps of running processes on the computer to capture gesture images, to classify each type of gesture image into a respective one of a plurality of classes depending on the type of gesture, and to associate each of the classes with one or more possible keys of the invisible keyboard, assign a probability to each of said possible keys, and integrate the probabilities assigned to the possible keys to identify a word for a sequence of gestures.

Claim 9: The method for producing a textual output in which a user makes typing like gestures relative to a virtual, invisible keyboard and without the presence of a real keyboard and the gestures are associated with the most probable keys that would be typed if a keyboard were presented, said method including the step of using a computer system to map gestures made, without touching any touch sensors, to keys of the virtual keyboard, including the step of running processes on the computer to capture gesture images, to classify each type of gesture image into a respective one of a plurality of classes depending on the type of gesture, and to associate each of the classes with one or more possible keys of the invisible keyboard, assign a probability to each of said possible keys, and integrate the probabilities assigned to the possible keys to identify a word for a sequence of gestures, and wherein the probability is computed using HMM.

Claim 10: A method of typing using a virtual keyboard having a multitude of virtual keys, comprising the steps:

making typing gestures relative to a virtual, invisible keyboard made without touching any touch sensors and without any real keyboard;

sensing the typing gestures; and

producing, from the sensed typing gestures, gesture associated textual output including the step of running processes on a computer to capture gesture images, classify each type of gesture image into a respective one of a plurality of classes depending on the type of

gesture, and to associate each of the classes with one or more possible keys of the invisible keyboard, assign a probability to each of said possible keys, and integrate the probabilities assigned to the possible keys to identify a word for a sequence of gestures.

Claim 11: A method according to Claim 10, wherein the typing gestures are made by a person, and further comprising the steps of providing feedback to the person on texture output associated with the gestures.

Claim 12: A method according to Claim 11, wherein the step of providing feedback includes the step of displaying an image of typing keys associated with the gestures.

Claim 14: A method of typing using a virtual invisible keyboard, comprising the steps:
making typing gestures relative to a virtual, invisible keyboard made without touching any touch sensors and without any real keyboard;

sensing the typing gestures; and

producing, from the sensed typing gestures, gesture associated textual output: and wherein the producing step includes the steps of classifying each type of gesture into a respective one of a plurality of classes depending on the type of gesture, associating each of said classes with one or more possible keys of the invisible keyboard, assigning a probability to each of said possible keys, and integrating the probabilities assigned to the possible keys to identifying a word for a sequence of gestures.

Claim 15: A method according to Claim 14, wherein the producing step further includes the step of associating gesture classes with individual typing keys.

Claim 16: A method according to Claim 14, further comprising providing training data in words or sentences with certain timing data.

Claim 17: A typing system using a virtual, invisible keyboard, comprising
means for sensing typing gestures made relative to a virtual, invisible keyboard made without touching any touch sensors and without any real keyboard; and

means for producing, from the sensed typing gestures, gesture associated textual output said producing means including a computer and processes running on the computer to capture gesture images, to classify each type of gesture image into a respective one of a plurality of classes depending on the type of gesture, and associate each of the classes with one or more possible keys of the invisible keyboard, assign a probability to each of said possible keys, and integrate the probabilities assigned to the possible keys to identify a word for a sequence of gestures.

Claim 18: A system according to Claim 17, wherein the typing gestures are made by a person, and further comprising means for providing feedback to the person on texture output associated with the gestures.

Claim 19: A system according to Claim 18, wherein the means for providing feedback includes means for displaying an image of typing keys associated with the gestures.

Claim 21: A typing system using a virtual invisible keyboard, comprising

means for sensing typing gestures made relative to a virtual, invisible keyboard made without touching any touch sensors and without any real keyboard; and

means for producing, from the sensed typing gestures, gesture associated textual output; and

wherein the producing means includes means for classifying each type of gesture into a respective one of a plurality of classes depending on the type of gesture, associating each of said classes with one or more possible keys of the invisible keyboard, assigning a probability to each of said possible keys, and integrating the probabilities assigned to the possible keys to identifying a word for a response of gestures.

Claim 22: A system according to Claim 21, wherein the producing means further includes means for associating gesture classes with individual typing keys.

Claim 23: A method according to Claim 10, wherein the step of running processes on the computer includes the step of mapping the sensed typing gestures to keys of the keyboard based on a statistical machine that interprets sequences of typing like gesture classes as intended words based on user typing gesture models.

Claim 24: A method according to Claim 10, wherein gesture input is represented as wave forms that are digitized and clustered in gesture frames, and then processed by HMM machines that represent difference models for different typing patterns; and the step of running processes includes the step of using two statistical components, a first statistical component to map gestures to keys, and a second, language model component to map keys to letters and words.